BRIEFER ARTICLES

THE RELATIVE IMPORTANCE OF DIFFERENT SPECIES IN A MOUNTAIN GRASSLAND

A careful study has been made by the writer through four seasons upon an area of dry grassland in a mountain park at Tolland, Colorado. The park (altitude 8889 feet) is a widened area in the valley of South Boulder Creek. The dry grassland covers most of those parts of the park that lie from 10 to 50 feet above the stream level.

As a part of the investigation 16 quadrats, each a meter square, were staked off and examined from time to time through the four seasons of study. Most of these quadrats are on morainic material, but a few are on the upper creek terraces. In the quadrats 64 species of plants were found, while the entire dry grassland area of the park showed 62 species in addition.

Estimates were made, as explained in a former paper,[1] of the amount of bare ground in each quadrat and also the area covered by each species of plant. By combining the figures for the different quadrats, the relative abundance of the various plants was determined. While the figures for the less frequent species are of little value, those for species occurring in any considerable number of quadrats show well the relation of these plants to the composition of the association as a whole. It is certain that every plant of frequent occurrence in the dry grassland of the park is represented in a number of quadrats.

The data for July 1913 are gathered together in table I. These midsummer records have been selected for presentation as probably of greater interest than would be the figures for spring or autumn. In certain genera two or more species of similar ecological nature have been put together as one item, the names arranged in order of importance.

According to the records, the two species present in the quadrats in greatest abundance are *Artemisia frigida* and *Aragallus Lambertii*, but *Muhlenbergia gracilis* and *Carex stenophylla* are almost equally important. Plants of the different species of *Carex* taken together cover a larger part of the area than do those of any single grass genus, but the grasses as a whole are of much greater importance than the sedges. The most abundant grasses are the species of *Muhlenbergia*,

[1] BOT. GAZ. 57:526–528. 1914.

TABLE I

PERCENTAGE COMPOSITION OF THE DIFFERENT QUADRATS, JULY 1913

	I	II	III	IV	V	VI	VII	VIII	IX	X	XII	XIIa	XIII	XIV	XV	XVI	Total	Percentage of ground covered	Percentage of total vegetation
Bare ground	30	33	50	13	20	28	20	45	20	10	15	15	20	25	25	30	399	24.94	.....
Small gray lichen	...	...	...	1	...	1	...	...	...	5	1	...	...	...	...	2	10	0.63	0.84
Selaginella densa	...	...	...	5	...	3	20	10	...	5	5	...	15	...	5	1	69	4.31	5.75
Agropyron violaceum	2	...	2	8	10	...	...	...	2	3	...	2	...	2	10	...	41	2.56	3.41
Agrostis hiemalis	2	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	2	0.13	0.17
Avena americana	...	...	1	...	...	...	...	...	...	5	...	...	10	...	...	...	16	1.00	1.33
Blepharineuron tricholepis	...	...	...	...	...	...	...	...	...	...	...	2	...	...	...	...	2	0.13	0.17
Bromus Pumpellianus	...	...	...	...	1	5	...	1	...	...	...	...	...	...	...	...	7	0.44	0.59
Danthonia Parryi and intermedia	...	...	...	...	...	...	...	...	...	2	5	...	...	...	10	4	21	1.31	1.75
Festuca ingrata, saximontana, rubra	5	...	...	5	12	15	19	...	...	10	...	26	...	...	...	...	92	5.75	7.67
Koeleria cristata	2	...	...	5	10	5	...	1	...	...	5	5	...	2	...	3	38	2.38	3.17
Muhlenbergia gracilis and subalpina	...	...	15	19	12	...	...	...	15	...	10	...	25	...	...	1	97	6.06	8.08
Poa interior, crocata, rupicola, subpurpurea	3	...	3	5	5	3	...	...	2	10	...	15	...	...	2	5	53	3.31	4.41
Sitanion elymoides	...	...	...	...	...	...	...	...	1	...	4	...	...	...	...	...	5	0.31	0.41
Stipa comata, minor, Nelsoni	...	...	...	...	2	...	...	...	29	...	1	...	...	...	...	...	32	2.00	2.66
Carex filifolia	...	...	...	...	...	...	...	...	...	5	20	...	...	...	16	...	41	2.56	3.41
Carex stenophylla and pennsylvanica	2	25	4	...	3	...	1	21	2	...	...	...	...	20	2	20	100	6.25	8.33
Juncus balticus	...	...	...	2	...	5	...	...	...	5	2	2	2	1	2	1	22	1.38	1.84
Allium recurvatum	...	...	...	...	...	...	...	1	...	...	...	...	...	...	...	...	1	0.06	0.08
Comandra pallida	...	...	...	...	3	...	...	...	5	...	2	...	...	...	2	...	12	0.75	1.00
Eriogonum umbellatum	...	...	...	...	5	...	...	...	10	...	5	...	...	...	...	...	20	1.25	1.67
Arenaria Fendleri	...	...	...	1	...	1	...	1	...	...	...	...	1	1	1	2	8	0.50	0.66
Cerastium occidentale	...	...	2	...	1	1	...	...	2	5	3	9	2	1	5	...	31	1.94	2.58
Silene Hallii	...	...	...	3	...	...	...	...	...	...	1	...	...	...	...	...	4	0.25	0.33
Erysimum Wheeleri	...	...	...	...	...	...	...	...	...	...	...	...	...	...	1	...	1	0.06	0.08
Sedum stenopetalum	...	2	2	1	3	1	...	1	3	...	2	2	2	1	5	...	25	1.56	2.08
Saxifraga rhomboidea	...	...	...	...	...	...	...	...	...	...	...	...	1	...	...	...	1	0.06	0.08

TABLE I—*Continued*

	I	II	III	IV	V	VI	VII	VIII	IX	X	XII	XIIa	XIII	XIV	XV	XIV	Total	Percentage of ground covered	Percentage of total vegetation
Potentilla pennsylvanica strigosa, concinna	1	2	...	1	...	...	...	1	1	...	...	...	...	11	...	...	17	1.06	1.41
Potentilla Hippiana, gracilis, Nuttallii	2	2	...	...	...	10	2	...	...	...	...	...	5	...	...	...	21	1.31	1.74
Aragallus deflexa	17	...	...	2	...	...	...	...	...	...	...	...	...	...	...	...	19	1.19	1.58
Aragallus Lambertii	...	5	...	12	5	2	...	10	...	10	5	...	5	20	5	...	79	4.94	6.58
Aragallus Richardsonii	20	...	...	4	...	...	...	...	1	...	...	...	...	10	...	2	37	2.31	3.08
Astragalus Parryi	...	...	...	...	...	...	...	...	1	...	...	...	...	...	...	...	1	0.06	0.08
Pseudocymopterus tenuifolius	...	...	...	...	...	...	1	...	...	...	...	1	1	...	...	...	3	0.19	0.25
Vaccinium caespitosum	...	...	...	...	...	...	20	...	...	...	...	...	...	...	...	...	20	1.25	1.66
Androsace puberulenta	...	...	...	...	...	...	...	...	...	...	...	...	...	...	1	...	1	0.06	0.08
Gentiana Parryi	...	...	...	1	...	...	3	...	...	...	...	...	...	...	...	...	4	0.25	0.33
Mertensia Bakeri	...	...	5	2	1	2	2	...	...	...	2	5	2	2	2	1	26	1.62	2.16
Orthocarpus luteus	...	...	...	2	...	...	...	...	...	5	...	1	...	...	...	10	18	1.12	1.49
Pentstemon procerus	...	...	...	...	...	...	3	...	...	...	...	2	...	...	...	...	5	0.31	0.41
Campanula petiolata	...	...	...	...	1	...	2	...	...	5	2	2	...	...	...	...	12	0.75	1.00
Achillaea lanulosa	...	...	5	...	...	...	2	...	1	...	...	5	3	...	...	...	16	1.00	1.33
Antennaria aprica	...	...	...	...	...	...	...	...	...	5	...	...	...	...	...	...	5	0.31	0.41
Artemisia aromatica	1	5	1	1	1	...	...	...	...	...	...	...	...	...	3	4	16	1.00	1.33
Artemisia frigida	10	25	5	5	5	5	1	...	5	5	10	2	5	2	...	5	90	5.62	7.49
Chrysopsis foliosa	1	...	3	...	...	8	4	...	...	5	...	2	1	...	3	1	28	1.75	2.33
Erigeron formosissimus	...	...	...	...	...	...	...	...	...	...	...	1	...	...	...	...	1	0.06	0.08
Erigeron trifidus	2	1	...	...	...	...	...	8	...	...	...	...	...	2	...	...	13	0.81	1.08
Gaillardia aristata	...	...	...	2	...	...	...	...	...	...	...	...	...	...	...	8	10	0.63	0.84
Solidago decumbens	...	...	...	...	...	5	...	...	...	...	...	...	...	...	...	...	5	0.31	0.41
Troximon glaucum	...	...	2	...	...	...	...	...	...	...	...	1	...	...	...	...	3	0.18	0.24
Total	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	1600	99.97	99.94

followed in order by the species of *Festuca*, *Poa*, *Agropyron*, *Koeleria*, and *Stipa*. If the dry grassland were to be named by its chief generic constituents, it would be called a *Carex-Artemisia-Aragallus-Muhlenbergia* association.

From table II it will be seen that in the midsummer of 1913 two-

TABLE II

THE CHIEF CONSTITUENTS OF THE VEGETATION OF THE QUADRATS

Names of plants	Percentage of ground covered	Percentage of vegetation
Selaginella densa	4.31	5.75
Agropyron violaceum	2.56	3.41
Festuca ingrata, saximontana, rubra	5.75	7.67
Koeleria cristata	2.38	3.17
Muhlenbergia gracilis and subalpina	6.06	8.08
Poa crocata, interior, rupicola, subpurpurea	3.31	4.41
Stipa comata, minor, Nelsoni	2.00	2.66
Carex filifolia	2.56	3.41
Carex stenophylla and pennsylvanica	6.25	8.33
Cerastium occidentale	1.94	2.58
Aragallus Lambertii	4.94	6.58
Aragallus Richardsonii	2.31	3.08
Artemisia frigida	5.62	7.49
Total	49.99	66.62

TABLE III

THE MOST IMPORTANT PLANT FAMILIES AND THEIR PART IN THE VEGETATION OF THE QUADRATS

Names of families	Percentage of ground covered	Percentage of vegetation
Poaceae (19 species)	25.38	33.82
Carduaceae (10 species)	11.49	15.30
Cyperaceae (3 species)	8.81	11.74
Fabaceae (4 species)	8.50	11.32
Selaginellaceae (1 species)	4.31	5.75
Total	58.49	77.93

thirds of the vegetation of the quadrats was made up of plants listed in 13 items in the first table. A certain few plants that are widely distributed do not make up a large percentage of the ground cover and are therefore not listed in table II. The most important of these are *Juncus balticus*, *Arenaria Fendleri*, *Sedum stenopetalum*, *Mertensia Bakeri*, and *Chrysopsis foliosa*, each of which was found in 9 or more of the quadrats.

The five plant families best represented in the quadrats are shown in table III.—FRANCIS RAMALEY, *University of Colorado, Boulder, Colo.*